

AMENDMENT TO THE CLAIMS

1. (Currently Amended) A miniature endoscope for orthopedic imaging comprising:

a probe for orthopedic diagnostic imaging, the probe including an optical waveguide that transmits an image, and having a diameter of less than 2 mm and a length between 2 cm and 10 cm;

a fiber optic illumination channel within the probe that is concentric about the optical waveguide, the illumination channel being positioned between an inner sheath and an outer sheath;

a handle removeably attached to the probe with a connector;

a light source mounted in the handle that is optically coupled to the fiber optic illumination channel;

a cannula that receives a distal end of the probe such that the outer sheath slides within the cannula, the cannula having a locking mechanism at a proximal end that attaches to the probe;

a sterile barrier that can be extended over the handle;

an optical lens coupled to a distal end of the waveguide;

an optical relay mounted in the handle and that is optically coupled to a proximal end of the waveguide; and

an imaging device mounted in the handle at a proximal end of the optical relay that receives an image from the optical waveguide.

2. (Original) The miniature endoscope of Claim 1 wherein the endoscope has an outer diameter of 1.6 mm or less.

3. (Original) The miniature endoscope of Claim 1 wherein the waveguide has an outer diameter between 0.6 and 1.6 mm.
4. (Previously Presented) The miniature endoscope of Claim 1 wherein the illumination channel includes a binary phase ring which disperses light from the illumination channel.
5. (Original) The miniature endoscope of Claim 1 wherein the waveguide comprises a glass having a refractive index in the range between 1.6 and 1.9.
6. (Original) The miniature endoscope of Claim 1 wherein the waveguide comprises a glass rod.
7. (Previously Presented) The miniature endoscope of Claim 1 wherein the optical waveguide further comprises a light absorbing layer having a thickness between 5 and 10 μ m.
8. (Previously Presented) The miniature endoscope of Claim 1 wherein the optical waveguide further comprises a light absorbing layer having an extramural absorption glass.
9. (Previously Presented) The miniature endoscope of Claim 1 wherein the optical waveguide further comprises a light absorbing layer having a refractive index of 1.6 or less.
10. (Previously Presented) The miniature endoscope of Claim 1 wherein the illumination channel has a wall thickness in a range of 0.1 mm and 0.2 mm.
11. (Previously Presented) The miniature endoscope of Claim 1 wherein the illumination channel has a refractive index in a range between 1.4 and 1.6.

12. (Previously Presented) The miniature endoscope of Claim 1 wherein the outer sheath comprises a metal tube.
13. (Original) The miniature endoscope of Claim 12 wherein the outer sheath comprises a polyamide coating.
14. (Original) The miniature endoscope of Claim 13 wherein the polyamide coating has a thickness between 100 and 150 μ m.
15. (Previously Presented) The miniature endoscope of Claim 1 wherein the optical relay comprises one or more lenses.
16. (Previously Presented) The miniature endoscope of Claim 1 wherein the optical lens comprises a plastic lens.
17. (Original) The miniature endoscope of Claim 1 wherein the imaging device comprises a charge coupled device.
18. (Previously Presented) The miniature endoscope of Claim 1 wherein the cannula further comprises a distal needle that penetrates tissue.
19. (Withdrawn) The miniature endoscope of Claim 1 wherein the optical element has a rectangular cross-sectional area.
20. (Withdrawn) The miniature endoscope of Claim I wherein the waveguide has a rectangular cross-sectional area.
21. (Withdrawn) The miniature endoscope of Claim 1 wherein the optical relay has a rectangular cross-sectional area.
22. (Previously Presented) The miniature endoscope of Claim 1 further comprising a display connected to the imaging device.
23. (Currently Amended) The miniature endoscope of Claim 1 wherein

the illumination channel is optically coupled to a light source with a lens in the handle.

24. (Currently Amended) The miniature endoscope of Claim 1 further comprising an optical coupler that optically connects ~~a the~~ light source to the illumination channel.

25. (Currently Amended) The miniature endoscope of Claim 1 wherein the cannula further comprises a fluid delivery ~~point~~ port.

26. (Previously Presented) The miniature endoscope of Claim 25 wherein the barrier is attached to a rigid waveguide housing that is connected to the handle.

27. (Currently Amended) The miniature endoscope of Claim 1 ~~further comprising a~~ wherein the light source comprises a lamp within the handle that is optically coupled to the illumination channel.

28. (Currently Amended) A miniature endoscope for orthopedic imaging comprising:

a probe for orthopedic diagnostic imaging, the probe including an imaging channel and having a diameter less than 2 mm;

a fiber optic illumination channel within the probe that is concentric about the imaging channel and ~~is coupled to a~~ light source mounted within the handle that is optically coupled to the fiber optic illumination channel;

a handle removably attached to the probe with a connector;

a cannula that receives a distal end of the probe such that the distal end of the probe slides within the cannula, the cannula having a locking mechanism at a proximal end that

attaches to the probe;

a sterile barrier that can be extended over the handle;

a first lens and a second lens that are optically coupled to a distal end of the imaging channel;

an optical relay mounted in the handle and coupled to a proximal end of the imaging channel; and

an imaging device mounted in the handle and coupled to a proximal end of the optical relay.

29. (Original) The miniature endoscope of Claim 28 wherein the imaging device comprises a charge coupled device.

30. (Original) The miniature endoscope of Claim 28 wherein the imaging channel comprises a transparent material having a refractive index of at least 1.6.

31. (Original) The miniature endoscope of Claim 30 wherein the imaging light channel comprises a glass rod.

32. (Original) The miniature endoscope of Claim 31 wherein the glass rod comprises an F2 or an F7 glass.

33. (Previously Presented) The miniature endoscope of Claim 28 further comprising a light absorbing layer around the imaging channel.

34. (Withdrawn) The miniature endoscope of Claim 33 wherein the light absorbing layer comprises a B6-2 glass or a BG-4 glass.

35. (Currently Amended) The miniature endoscope of Claim 28 wherein the illumination channel is coupled to ~~a~~the light source with a fiber optic connector.

36-38 (Cancelled)

39. (Previously Presented) The miniature endoscope of Claim 28 wherein the endoscope has a display connected to the imaging device for arthroscopic examination.
40. (Withdrawn) The miniature endoscope of Claim 28 wherein the optical element has a rectangular cross-sectional area.
41. (Withdrawn) The miniature endoscope of Claim 28 wherein the imaging channel has a rectangular cross-sectional area.
42. (Withdrawn) The miniature endoscope of Claim 28 wherein the optical relay has a rectangular cross-sectional area.
43. (Withdrawn) A method of forming a reflective boundary on a glass channel for a microendoscope comprising the steps:
 providing a glass channel for a microendoscope; providing a light absorbing material;
 extruding the light absorbing material over the glass channel to form a reflective boundary on the glass channel.
44. (Withdrawn) The method of Claim 43 further comprising the step of using a fiber optic drawing process to extrude the light absorbing material over the glass channel.
45. (Withdrawn) The method of Claim 43 further comprising the step of using a bar-in-tube drawing process to extrude the light absorbing material over the glass channel.
46. (Withdrawn) A method of forming an image light channel for a microendoscope comprising the steps:
 providing an illumination channel having a refractive

index;

coating an inner surface and an outer surface of the illumination channel with a material having a refractive index lower than the illumination channel refractive index;

providing an image light channel for a microendoscope; and

attaching the illumination channel to the image light channel.

47. (Withdrawn) The method of Claim 46 further comprising the step of using a tube-extrusion process for form the coatings on the illumination channel.
48. (Withdrawn) The method of Claim 46 further comprising the step of depositing a glass on the outer surface and the inner surface of the illumination channel.
49. (Withdrawn) The method of Claim 46 further comprising the step of using a bar-in-tube fiber drawing process to fuse the illumination channel to the image light channel.
50. (Withdrawn) A method of forming a cladding structure on an image light channel for a microendoscope comprising the steps:
 - providing an image light channel;
 - forming a material having an index of refraction on the image light channel that is lower than the index of refraction of the image light channel to form a first cladding; extruding an illumination channel over the first cladding on the image light channel; and
 - forming a second cladding on the illumination channel.
51. (Currently Amended) A miniature endoscope for orthopedic

imaging comprising:

a handle having an imaging device, a light source mounted within the handle and a first coupling element;

a sterile barrier that can be extended over the handle;

a rigid probe removeably attached to the handle with a connector and having a diameter of less than 2 mm for insertion within an orthopedic body portion of a patient, an illumination waveguide that is concentric about an imaging channel and a second coupling element that connects the rigid probe to the first coupling element such that the imaging channel is optically coupled to the imaging device;

a cannula having a fluid delivery port; and

a lens at a distal end of the imaging channel.

52. (Withdrawn) The endoscope of Claim 51 further comprising:

a beamsplitter mounted within the housing wherein the beam splitter directs light from the lighting source through a rod and lens assembly to an object such that the beam splitter receives light from an object through the rod and lens assembly and directs the light to the imaging device.

53. (Withdrawn) The endoscope of Claim 51 wherein the waveguide comprises a hollow channel.

54. (Withdrawn) The miniature endoscope of Claim 51 wherein the imaging device comprises a plurality of lenses and a polarizer.

55. (Withdrawn) The miniature endoscope of Claim 54 wherein the polarizer comprises a sheet polarizer.

56. (Withdrawn) The miniature endoscope of Claim 54 wherein the

polarizer comprises a cross polarizer.

57. (Withdrawn) The miniature endoscope of Claim 56 wherein the cross polarizer comprises a first prism and a second prism.
58. (Withdrawn) The miniature endoscope of Claim 51 wherein the light source is coupled to a polarizer and a lens.
59. (Previously Presented) The miniature endoscope of Claim 51 wherein the light source is coupled to the illumination waveguide with a fiber optic element.
60. (Previously Presented) The miniature endoscope of Claim 51 wherein the probe comprises a fiber optic illumination channel around the imaging channel, the imaging channel further comprising a second lens at the distal end of the imaging channel.
61. (Currently Amended) The miniature endoscope of Claim 51 wherein the light source comprises ~~an external~~ a lamp within the handle.
62. (Currently Amended) The miniature endoscope of Claim 61 wherein the ~~external lamp comprises a xenon light source~~ is coupled to the illumination waveguide with a lens.
63. (Previously Presented) The miniature endoscope of Claim 51 wherein the sterile barrier is attached to the probe.
64. (Previously Presented) The miniature endoscope of Claim 63 wherein the sterile barrier is attached to a disposable probe element.
65. (Previously Presented) The miniature endoscope of Claim 51

wherein the cannula has a locking mechanism that attaches the cannula to the probe.

66. (Previously Presented) The miniature endoscope of Claim 51 wherein the probe fits within the cannula.
67. (Currently Amended) The miniature endoscope of Claim 66 wherein the imaging channel comprises a rod and wherein the endoscope further comprises a locking mechanism wherein the cannula locks onto a hub on the probe.
68. (Previously Presented) The miniature endoscope of Claim 66 wherein the cannula comprises a needle.
69. (Original) The miniature endoscope of Claim 66 wherein the cannula further comprises a stylet.
70. (Withdrawn) A method of using a miniature endoscope comprising:
 providing a base unit and a sheath assembly having a probe waveguide and a sterile barrier; and
 attaching the sheath assembly to the base unit such that the sterile barrier extends over the base unit.
71. (Withdrawn) The method of Claim 70 further comprising providing a cannula and securing the cannula to the sheath assembly.
72. (Withdrawn) The method of Claim 70 further comprising providing a luer fitting on the sheath assembly.
73. (Withdrawn) The method of Claim 70 further comprising disposing of the sheath assembly after use and attaching a

second sheath assembly to the base unit for further use.

- 74. (Withdrawn) The method of Claim 70 further comprising providing a probe waveguide having a hollow channel and a light absorbing channel wall.
- 75. (Withdrawn) The method of Claim 70 further comprising providing a base unit including a handle, an imaging device within the handle and a relay optical system that couples an image from the waveguide to the imaging device.
- 76. (Withdrawn) The method of Claim 70 further comprising providing a probe waveguide having a diameter of 2 mm or less.
- 77. (Withdrawn) The method of Claim 70 further comprising connecting the base unit to a display.
- 78. (Withdrawn) The method of Claim 70 further comprising providing an annular illumination channel in the probe.
- 79. (Withdrawn) The method of Claim 70 further comprising providing a probe waveguide having a length between 2 cm and 10 cm.
- 80. (Withdrawn) The method of Claim 70 further comprising directing polarized light through the waveguide.